



# Worms and Mollusks

## Section 1

### Flatworms

**MAIN Idea** Flatworms are thin, flat, acoelomate animals that can be free-living or parasitic.

## Section 2

### Roundworms and Rotifers

**MAIN Idea** Roundworms and rotifers have a more highly evolved gut than flatworms derived from a pseudocoelomate body plan.

## Section 3

### Mollusks

**MAIN Idea** Mollusks are coelomates with a muscular foot, a mantle, and a digestive tract with two openings.

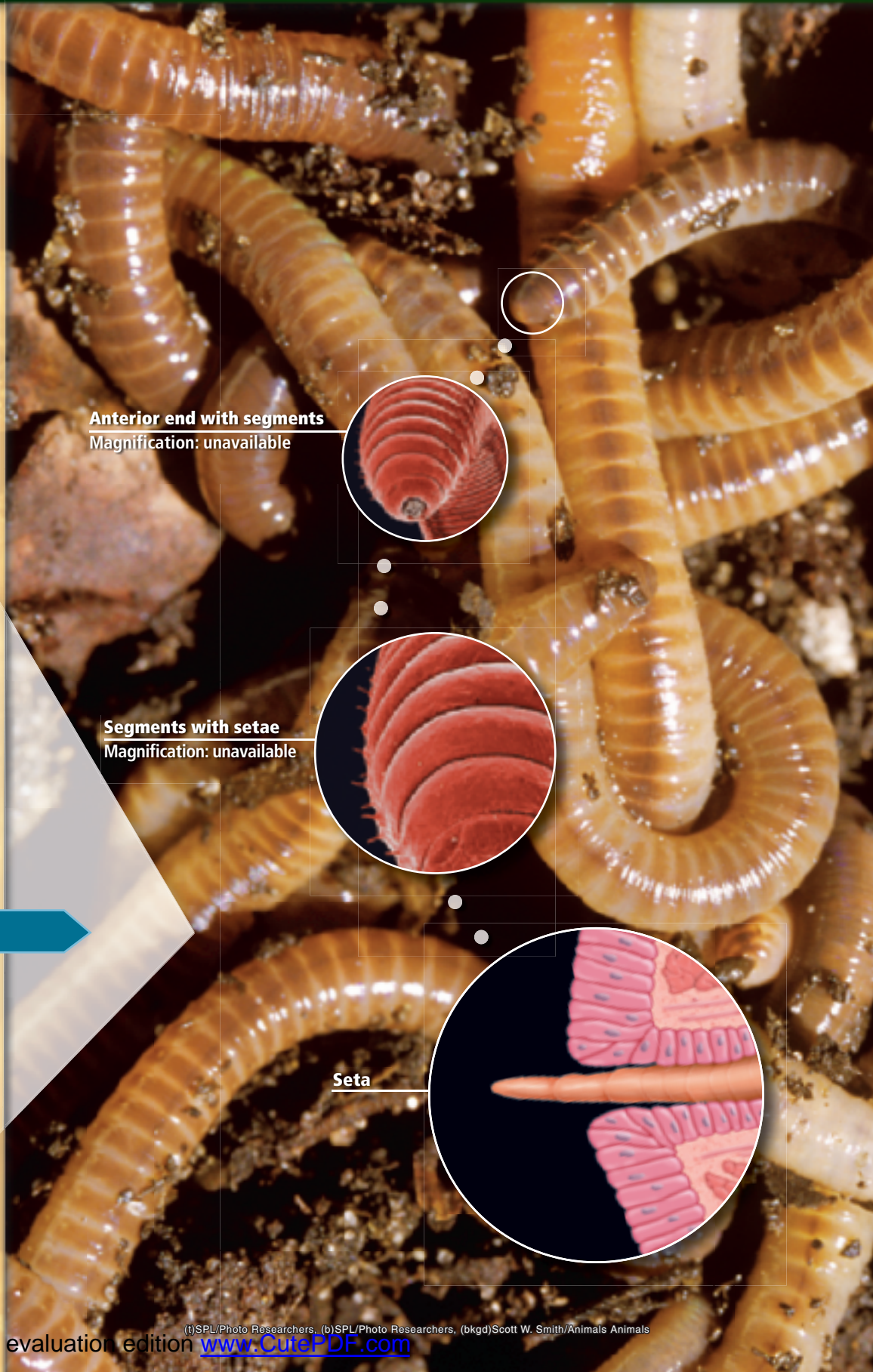
## Section 4

### Segmented Worms

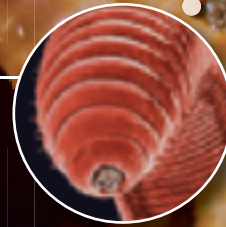
**MAIN Idea** Segmented worms have segments that allow for specialization of tissues and for efficiency of movement.

## BioFacts

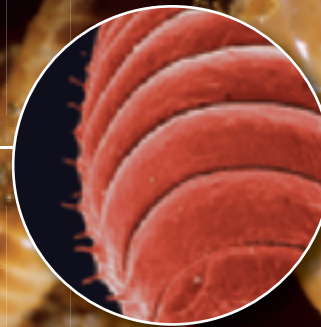
- One hectare of soil can hold over 2.5 million earthworms.
- An earthworm's setae can hold it so firmly to soil that a bird cannot pull the worm from its burrow.
- The African giant earthworm can reach lengths of almost 7 m.



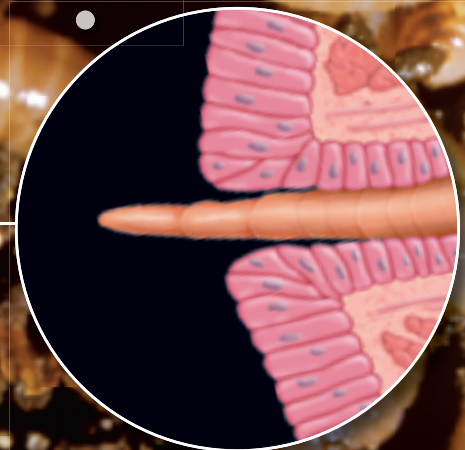
**Anterior end with segments**  
Magnification: unavailable



**Segments with setae**  
Magnification: unavailable



**Seta**



# Start-Up Activities

## LAUNCH Lab

### What do earthworms feel like?

In this lab, you will examine a familiar worm—an earthworm like the ones on the facing page.

**Procedure** 

1. Read and complete the lab safety form.
2. Obtain an **earthworm** from your teacher.  
**WARNING: Treat the earthworm in a humane manner at all times.**
3. Run your finger along the ventral side, or underside, of the worm. Repeat in the opposite direction. Record your observations.
4. Examine the ventral side of the worm with a **magnifying glass**. Record your observations.
5. Wash your hands and return the earthworm to your teacher.

### Analysis

1. **Compare** the way the earthworm felt to you when you brushed it in each direction.
2. **Infer** how any differences you observed might be important adaptations.
3. **Interpret** What did you see on the worm's ventral side that might explain how the worm felt to you?



Visit [biologygmh.com](http://biologygmh.com) to:

- ▶ study the entire chapter online
- ▶ explore Concepts in Motion, the Interactive Table, Microscopy Links, Virtual Labs, and links to virtual dissections
- ▶ access Web links for more information, projects, and activities
- ▶ review content online with the Interactive Tutor, and take Self-Check Quizzes

## FOLDABLES™ Study Organizer

**Segmented Worms** Make the following Foldable to help you describe the three main classes of segmented worms.

- ▶ **STEP 1** Fold a piece of paper into thirds vertically.



- ▶ **STEP 2** Fold the paper down 2.5 cm from the top.



- ▶ **STEP 3** Unfold and draw lines along the 2.5-cm fold. Label the tabs *Earthworms*, *Bristleworms*, and *Leeches* as shown.



**FOLDABLES** Use this Foldable with Section 25.4. As you read the section, describe the features and unique characteristics of each class in the appropriate column.



## Section 25.1



**SB3b.** Compare how structures and function vary between the six kingdoms (archaeobacteria, eubacteria, protists, fungi, plants, and animals). **Also covers:** SCSH2a–b, SCSH9c–d, SB1d

### Objectives

- D Compare** the adaptations of free-living flatworms to parasitic flatworms.
- D Explain** how flatworms maintain homeostasis.
- D Compare** the three classes of flatworms.

### Review Vocabulary

**acoelomate:** an animal without any body cavities

### New Vocabulary

pharynx  
flame cell  
ganglion  
regeneration  
scolex  
proglottid

## Flatworms

**MAIN Idea** Flatworms are thin, flat, acoelomate animals that can be free-living or parasitic.

**Real-World Reading Link** Think about a time you were caught in an unexpected rain shower without rain gear. If you were wearing layers of clothing, the rain might not have soaked through to your skin. As you read about worms, think about how it is easier for the rain to move through one thin layer than through multiple heavy layers.

### Body Structure

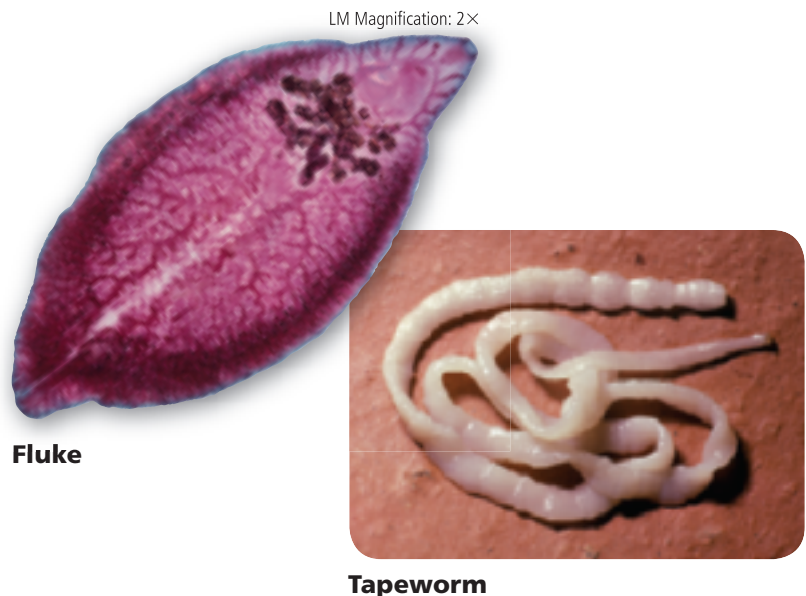
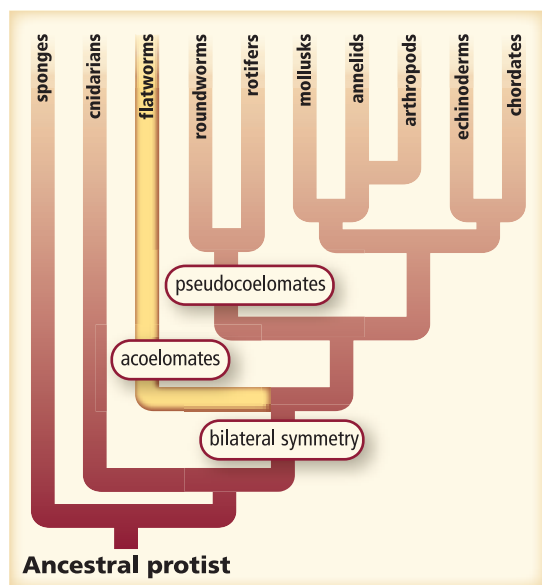
The evolutionary tree in **Figure 25.1**, shows that flatworms are on the acoelomate branch of the tree, while roundworms are on the pseudocoelomate branch. However, flatworms and roundworms both have bilateral symmetry—they can be divided along only one plane into mirror-image halves. Bilateral symmetry is a major evolutionary step that allows parts of the body to evolve different organs. Animals that have bilateral symmetry also have more efficient movement than animals with radial symmetry.

Phylum Platyhelminthes (pla tee HEL min thee)—the flatworms—consists of about 20,000 species. **Figure 25.1** shows some of the variety seen in flatworms. Flatworms range in length from many meters to 1 mm or less. They have thin, flat bodies that resemble a ribbon. Unlike sponges and cnidarians, flatworms have a definite head region and body organs. Flatworms are acoelomates. They lack a coelom—their bodies have no cavities.

Most flatworms are parasites living in the bodies of a variety of animals, while others are free-living in marine, freshwater, or moist land habitats. Freshwater planarians often are seen on the underside of rocks in swiftly flowing streams.

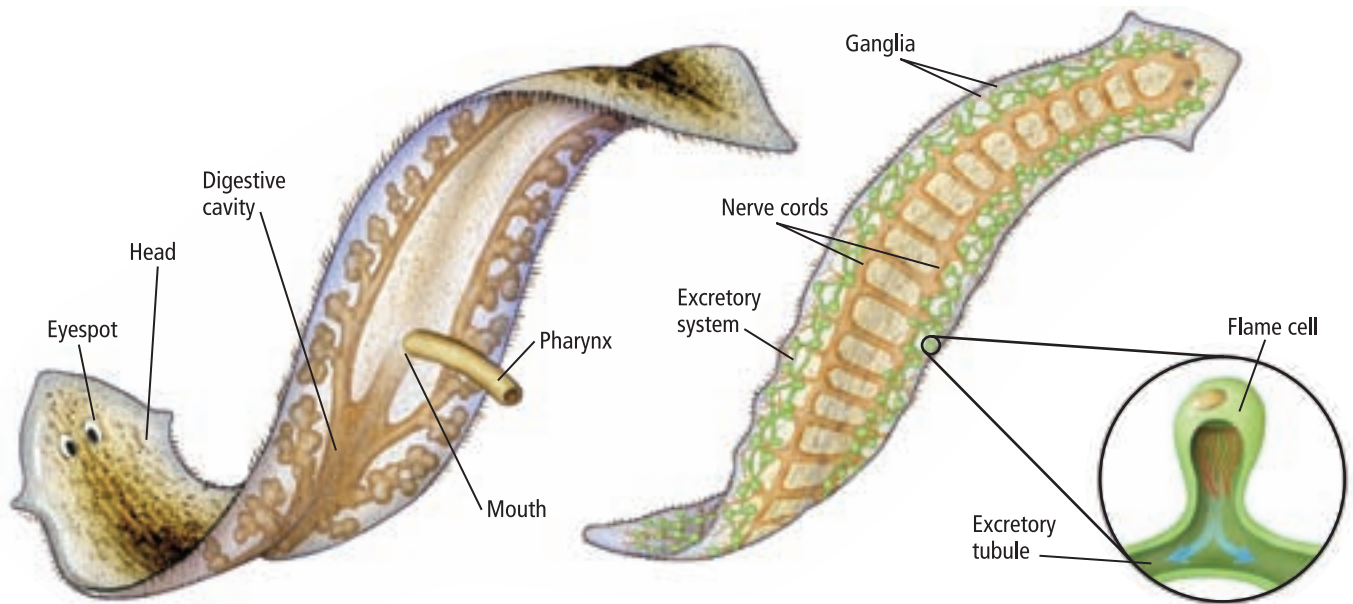
■ **Figure 25.1** Notice on the evolutionary tree that flatworms, such as flukes and tapeworms, were among the first animals to show bilateral symmetry.

**Explain** how the symmetry of flatworms is different from that of cnidarians.



Fluke

Tapeworm




■ **Figure 25.2** Simple organ systems, such as the excretory and nervous systems, are found in flatworms.



**Interactive Figure** To see an animation of the basic anatomy of a planarian, visit [biologygmh.com](http://biologygmh.com).

**Feeding and digestion** Free-living flatworms feed on dead or slow-moving organisms. They extend a tubelike muscular organ, called the **pharynx** (FAHR ingks), out of their mouths. The pharynx, shown in **Figure 25.2**, releases enzymes that begin the digestion of prey. Then food particles are sucked into the digestive tract where digestion continues. Because flatworms have only one body opening, wastes are ejected through the mouth.

Parasitic flatworms have modified feeding structures called hooks and suckers, which enable them to stay attached to their hosts. Some parasitic flatworms have a reduced digestive system and feed on blood and other body tissues. Other parasitic flatworms lack a digestive system. Because they are so thin, like a single layer of cloth, and are surrounded by nutrients in their host's intestines, these parasites can absorb directly through their body walls partially or completely digested food eaten by the host.

 **Reading Check Compare** feeding and digestion in free-living flatworms and parasitic flatworms.

**Respiration, circulation, and excretion** Like sponges and cnidarians, flatworms do not have circulatory organs or respiratory organs. Because flatworms are so thin, their cells can use the process of diffusion to move dissolved oxygen and nutrients to all parts of their bodies. Carbon dioxide and other wastes also are removed from flatworm cells by diffusion.

Unlike sponges and cnidarians, flatworms have an excretory system that consists of a network of small tubes that run through the body. On side branches of the tubes, as shown in **Figure 25.2**, bulblike **flame cells** lined with cilia sweep water and excretory substances into tubules. These substances then exit through pores to the outside of the body. Flame cells were named because the flickering movements of the cilia inside the cells look like the light of a candle flame. Because flame cells move water out of the body, they keep flatworm cells from becoming waterlogged. In addition to the action of flame cells, flatworms also excrete waste products and maintain homeostatic water balance through their mouths.

## VOCABULARY

### SCIENCE USAGE V. COMMON USAGE

#### Host

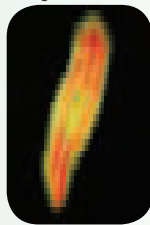
**Science usage:** an animal or plant on which or in which a parasite lives.  
*Some parasitic worms live in the intestines of their hosts.*

**Common usage:** a person who entertains guests.

*Tyler's dad was the host for the football party.*

## MiniLab 25.1

LM Magnification: 10×



Planarian

### Observe a Planarian

#### How does a planarian behave?

Investigate the physical features and behavior of a planarian by observing this common flatworm.

#### Procedure



1. Read and complete the lab safety form.
2. Observe the **planarian** in a **water-filled observation dish** by using a **magnifying glass**.
3. Create a data table to record your observations.
4. Record the physical characteristics and behaviors of the flatworm.
5. Place a small piece of **cooked egg white** into the dish, and observe the feeding behavior of the planarian.

#### Analysis

1. **Compare and contrast** the physical features of the planarian with the features of the earthworm you observed in the Launch Lab.
2. **Analyze** how the body shape and movement of a planarian enables it to live in its environment.
3. **Infer** why scientists classify planaria into a group separate from other worms.

**Response to stimuli** The nervous system regulates the body's response to stimuli. In most flatworms, the nervous system consists of two nerve cords with connecting nerve tissue that run the length of the body. In most flatworms, the connecting nerve tissue looks like the rungs of a ladder, as illustrated in **Figure 25.2**. At the anterior end of the nerve cords is a small swelling composed of ganglia that send nerve signals to and from the rest of the body. A **ganglion** (plural, ganglia) is a group of nerve cell bodies that coordinates incoming and outgoing nerve signals.

**Movement** Some flatworms move by contracting muscles in the body wall. To escape predators and to find food, most free-living flatworms glide by using cilia located on their undersides. Mucus lubricates the worms and improves the gliding motion, while muscular action lets the animals twist and turn. If you ever have tried to loosen planaria worms from the bottoms of rocks, you know that their outer mucus covering enables them to stick tightly—an important adaptation in a swiftly moving stream. You can observe the features and behavior of a flatworm in **MiniLab 25.1**.

**Reproduction** Flatworms are hermaphrodites because they produce both eggs and sperm. During sexual reproduction, two different flatworms exchange sperm, and the eggs are fertilized internally. In marine flatworms, zygotes in cocoons are released into the water where they hatch within a few weeks.

Free-living flatworms can reproduce asexually by **regeneration**—a process in which body parts that are missing due to damage or predation can be regrown. A planarian that is cut in half horizontally can grow a new head on the tail end and a new tail on the head end, forming two new organisms, as shown in **Figure 25.3**.



■ **Figure 25.3** Two new planaria form when one planarian is cut in half horizontally. Some planaria can regenerate from almost any piece of their bodies.



## Diversity of Flatworms

There are three main classes of flatworms: Turbellaria (tur buh LER ee uh), Trematoda (trem uh TOH duh), and Cestoda (ses TOH duh). Class Turbellaria consists of the free-living flatworms. Class Trematoda and class Cestoda consist of parasitic flatworms.

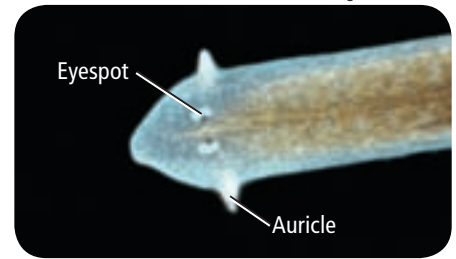
**Turbellarians** Members of the class Turbellaria are called turbellarians. Most turbellarians, like planarians, live in marine or freshwater habitats, while some live in moist soils. They vary in size, color, and body shape. As shown in **Figure 25.4**, turbellarians have eyespots that can detect the presence or absence of light. They also have sensory cells that help them identify chemicals and water movement.

The cells sensitive to chemicals are concentrated on small projections called auricles (OR ih kulz) at the anterior end of the worm. When a planarian hunts, it might wave its head back and forth as it crawls forward, exposing the auricles to chemical stimuli coming from food. At the same time, its eyespots might help it perceive light conditions that would protect it from predators.

**Trematodes** Flukes belong to class Trematoda—the trematodes. They are parasites that infect the blood or body organs of their hosts. The life cycle of the parasitic fluke *Schistosoma* is shown in **Figure 25.5**. Notice that this parasite requires two hosts to complete its life cycle.

When humans contract schistosomiasis (shihst tuh soh MI uh sis), the fluke eggs clog blood vessels, causing swelling and eventual tissue damage. Schistosomiasis can be prevented by proper sewage treatment and by wearing protective clothing when wading or swimming in infested water. Schistosomiasis infections are not common in the United States.

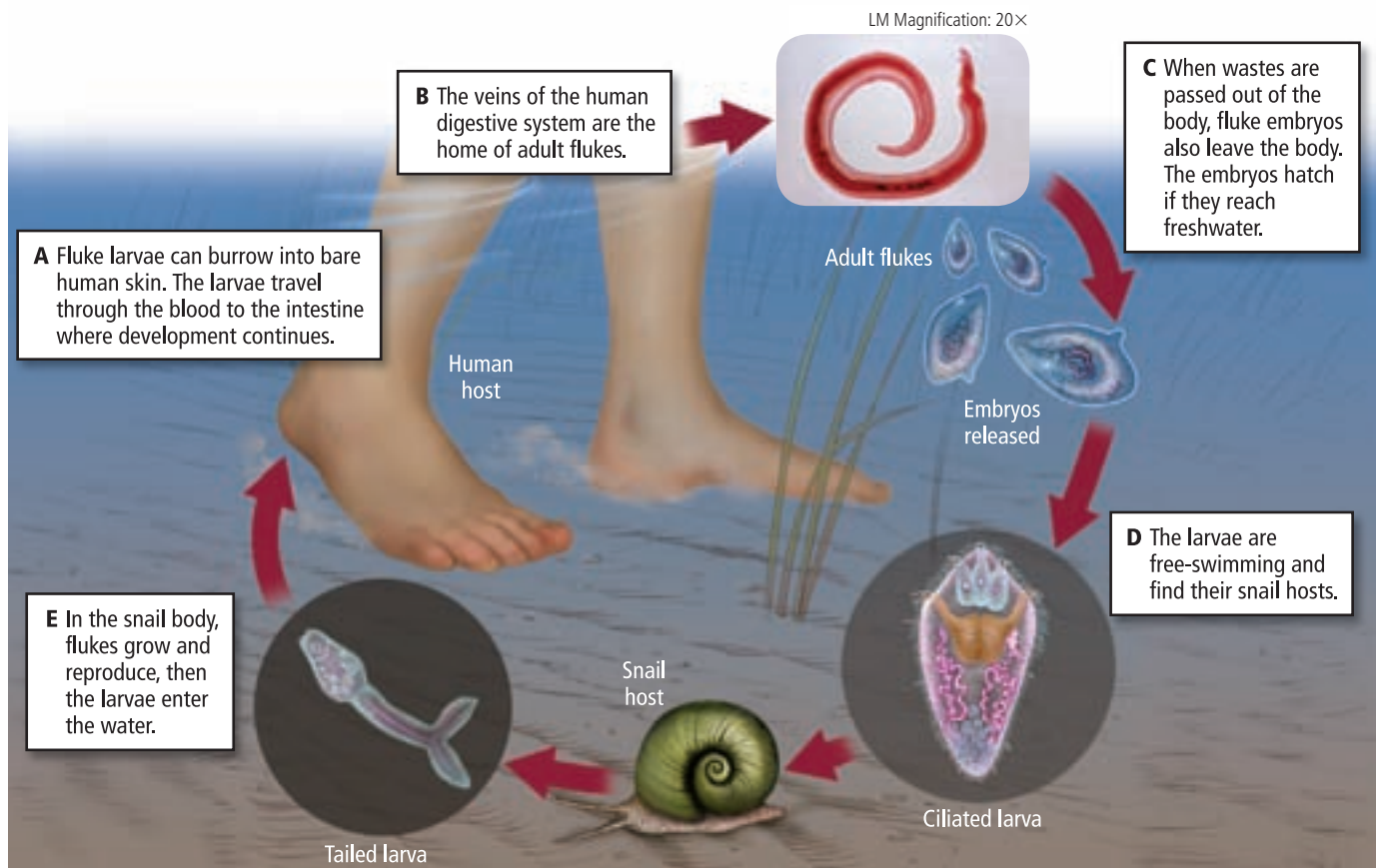
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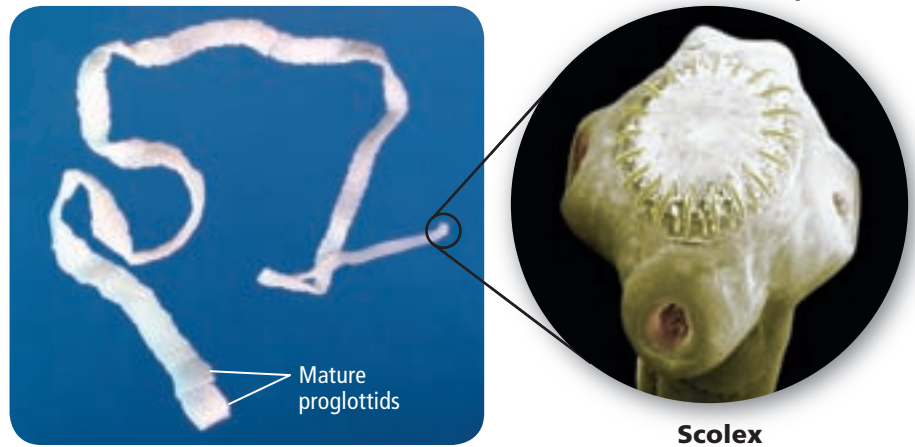
■ **Figure 25.4** Dark clusters of light-sensitive cells form the eyespots on this planarian. Note the auricles projecting from the same area.

■ **Figure 25.5** Two hosts—humans and snails—are needed to complete the life cycle of the fluke *Schistosoma*.

**Infer** Why are the two larval forms of the fluke different shapes?



■ **Figure 25.6** As the proglottids behind the scolex mature, new proglottids form.



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**Cestodes** All tapeworms are members of class Cestoda—the cestodes. They are parasites adapted to life in the intestines of their hosts. Look at the anterior end, or head, of the tapeworm in **Figure 25.6**. This is the **scolex** (SKOH leks), a knob-shaped structure with hooks and suckers that attach to the intestinal lining of a host such as a cow or a human.

Behind the scolex of the worm are a series of individual sections called **proglottids** (proh GLAH tihdz), each of which contains muscles, nerves, flame cells, and male and female reproductive organs. Proglottids form continuously; as new ones form near the scolex, older proglottids move farther back and mature. After eggs in the mature proglottids are fertilized, the last segments with developing embryos break off and pass out of the intestines of their hosts. Animals such as cattle might feed on vegetation or drink water contaminated by the tapeworm proglottids, and then the cycle of tapeworm growth is repeated.

When eaten by cattle, tapeworms can burrow through intestinal walls, entering blood and eventually muscle. If this infected beef is eaten rare or undercooked, human infection by tapeworms is likely. Tapeworm infections are uncommon in developed countries because these countries require beef inspections.

## Study Tip

**Summarization** Develop a summary paragraph that addresses the body structure, reproduction, and life cycle of the tapeworm. Share your summary statement with the class.

## Section 25.1 Assessment

### Section Summary

- ▶ Flatworms were among the first animals to exhibit bilateral symmetry.
- ▶ Flatworms are acoelomates with limited numbers of organs and systems.
- ▶ Some flatworms are free-living, and others are parasitic.
- ▶ The three main classes of flatworms are Turbellaria, Trematoda, and Cestoda.
- ▶ Flatworms that are parasitic have specialized adaptations for parasitic life.

### Understand Main Ideas

1. **MAIN Idea Evaluate** the advantages of a flatworm's thin body.
2. **Compare and contrast** the adaptations of free-living flatworms and parasitic flatworms.
3. **Prepare** a chart that compares digestion, respiration, movement, and reproduction in the free-living and parasitic flatworms.
4. **Analyze** the importance of flame cells in a flatworm.

### Think Scientifically

5. *Design an experiment* to determine what habitat conditions planarians prefer.
6. *Evaluate* how the two classes of parasitic worms are adapted to their habitats.
7. *Diagram* bilateral symmetry using a planarian as an example. Explain the adaptive advantage of bilateral symmetry to a planarian.